## Summary of lecture 22

Heat capacity of solids: Debye's theory
 Phonon spectrum in a solid ~ photon spectrum in a photon gas.
 Key difference: phonon's cannot have frequency greater than some maximum,
 i.e. Debye cut-off frequency is

$$\omega_D = \left(6\pi^2 \frac{N}{V}\right)^{1/3} u_s$$

The heat capacity is

$$C = 3Nk \left[ \frac{3}{x_D^3} \int_0^{x_D} \frac{x^4 e^x}{(e^x - 1)^2} \, dx \right]$$

where  $x_D = \frac{h\omega_D}{kT}$ 

At large temperatures: C 
ightarrow 3Nk At low temperatures:  $C \propto T^3$